



UNITED STATES PATENT AND TRADEMARK OFFICE

28

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/916,689	07/30/2001	Teruhisa Hayashi	Q65182	8831

7590 01/07/2004

SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC
Suite 800
2100 Pennsylvania Avenue, N.W.
Washington, DC 20037-3213

EXAMINER

PATEL, ISHWARBHAI B

ART UNIT PAPER NUMBER

2827

DATE MAILED: 01/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/916,689	HAYASHI ET AL.	
	Examiner	Art Unit	
	Ishwar (I. B.) Patel	2827	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 3-14 is/are pending in the application.
- 4a) Of the above claim(s) 5,8,11,12 and 14 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 3,4,6,7,9,10 and 13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☒ All b) ☐ Some * c) ☐ None of:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
 a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) : . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's elections without traverse of group I, claims 1-10, along with new claims 13 and 14, and specie I, reading on figure 1A-1B, claims 3,4,6,7, 9-11 and 13 in papers filed on November 6, 2003 is acknowledged.

Claim 11, which is a method claim, belonging to the non elected group II, has been withdrawn from further consideration.

However, if a generic claim is allowed, additional claims, which are written in dependent form or otherwise include all the limitation of the allowed claim, will be rejoined and will be fully examined for the patentability.

Claims 3, 4, 6, 7, 9-10 and 13 are examined for patentability.

Claims 11-12, 14, 5 and 8 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected group / specie.

Priority

2. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d).

Also acknowledged is the receipt of the priority papers, which have been placed of record in the file.

Claim Objections

3. Claims 4 and 6 objected to because "the height" in both the claims lacks the antecedent basis.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakatani et al., US Patent No. 6,038,133, hereafter, Nakatani, in view of Pasch, US Patent No. 5,776,551 and Nomura, US Patent No. 5,335, 139.

Regarding claim 3, Nakatani discloses a printed wiring substrate comprising:

a core substrate having a front surface and a back surface (insulating substrate 401b, see figure 4, column 11, line 7-35); and

an electronic component embedded in said core substrate (circuit component 403, see figure 4, column 11, line 7-35, which may be an active device or a passive device, column 7, line 31-39);

said printed wiring substrate characterized in that: said core substrate embedding the electronic component in the core substrate contains an inorganic filler (insulating

substrate 401b formed of a mixture comprising an inorganic filler, having an average particle size of 0.01 μm to 10 μm , column 11, line 7-35); but

Nakatani fails to explicitly disclose an electrode projecting from at least either an upper end or a lower end said electronic component, however, Nakatani further discloses that projecting electrodes, such as gold bond or solder bump may be formed instead of conductive adhesive, column 9, 15-24.

Pasch discloses a flip chip die with bump electrode with size of about 50 μm to 100 μm .

Nomura discloses a chip capacitor with external electrodes 4 with the thickness suitably determined in accordance with the particular purpose in the ranges from about 10 μm to about 50 μm .

A person of ordinary skill in the art at the time of the applicant's invention, as further suggested by Nakatani, would be motivated to provide projecting electrode / bump to have reliable electric connection and with a suitable height to maintain a desired gap between the component body and connecting electrode / pad of the substrate.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the board of Nakatani with said electronic component having projecting electrode, from the further suggestion of Nakatani and teaching of Pasch and Nomura, in order to have reliable electrical connection with a

height selected to have desired gap between the component body and the connecting electrode / pad of the substrate.

6. Claims 6 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Nakatani, Pasch and Nomura, as applied to claim 3 above, and further in view of Papathomas et al., US Patent No. 6,129,955, hereafter, Papathomas.

Regarding claims 6 and 9, the applicant is further claiming the inorganic filler has a particle size not greater than one-half the height of said electrode, as claimed in claim 6 and the inorganic filler has a particle size not greater than 25 μm , and the electrode has a height of at least 50 μm , as claimed in claim 9.

The combination of Nakatani, Pasch and Nomura fails to disclose such relation between the size of the filler particles in the resin and the height of the said electrode.

However, as further disclosed by Nakatani, the inorganic filler is used in the resin to swiftly conducts heat generated in the circuit components, and it will be inherent to have filler size much smaller than the gap between component and the contact surface of the connecting substrate to have the filler around the electrode and the component to have better heat dissipation rate. The gap is controlled by the height of the electrode.

Papathomas discloses encapsulation with a resin having thermally conductive fillers, such as Aluminum Oxide, Aluminum Nitride, Silicon Nitride, Silicon Carbide, Beryllium Oxide and Boron Nitride to improve the thermal heat transfer from the device to the surrounding, and further discloses that the particle size of the filler should be from 0.5 μm to about 31 μm , so that the uncured composition flows readily and will flow under integrated circuit chip housing 31, between the housing 31 and the substrate 11, see column 14, line 65-67 to column 15, line 1-23.

A person of ordinary skill in the art at the time of applicant's invention would have recognized that providing the filler of the resin compound as small as possible compare to the height of the electrodes of the electronic component would enhance the heat conduction rate from the electronic component and improve the performance of the device, as the smaller filler particles would help in a better flow of the composition in the narrow regions between the individual electrodes and between the electronic component surface and the respective connecting surface.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the printed wiring board of the combination of Nakatani, Pasch and Nomura, with the inorganic filler having a particle size not greater than one-half the height of said electrode, as claimed in claim 6 and the inorganic filler having a particle size not greater than 25 μm , and the electrode has a height of at least 50 μm , as claimed in claim 9, from the teachings of Papathomas, in

order to improve the heat dissipation rate and resultant better performance of the device.

Further, when the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

7. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nishiyama, US Patent No. 6,324,067, in view of Nakatani et al., US.

Regarding claim 13, Nishiyama discloses a core substrate having a front surface and a back surface (see figure 6, column 6, line 15-20); and

an electronic component embedded in said core substrate (component 4, see figure 6, column 6, line 15-20);

said electronic component has an electrode projecting from at least either an upper end or a lower end said electronic component, see figure 6.

wherein said electronic component is embedded in the core substrate via a resin in a through-hole extending through said core substrate between the front surface and the back surface of the core substrate (component 4 and sealing resin 9, see figure 6, column 6, line 15-20); but

Nishiyama fails to explicitly disclose said resin contain inorganic filler.

Nakatani discloses a circuit component embedded in the core substrate 401b formed of a mixture comprising an inorganic filler having an average particle size of 0.01

µm to 10 µm, column 11, line 7-35, to have better heat dissipation rate from the component.

A person of ordinary skill in the art at the time of the applicant's invention would have recognized the advantage of using inorganic filler in the resin sealing of Nishiyama to enhance the heat transfer rate from the component to improve the performance of the device.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the resin filled in core substrate of Nishiyama with inorganic filler, from the teachings of Nakatani, in order to enhance the heat transfer rate from the component to improve the performance of the device.

8. Claims 4, 7 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Nishiyama and Nakatani, as applied to claims 13 above, and further in view of Pasch, US Patent No. 5,776,551, Nomura, US Patent No. 5,335, 139 and Papathomas et al., US Patent No. 6,129,955, hereafter, Papathomas.

Regarding claims 4, 7 and 10, the applicant is further claiming the inorganic filler has a particle size not greater than one-half the height of said electrode, as claimed in claim 4 and the inorganic filler has a particle size not greater than 25 µm, and the electrode has a height of at least 50 µm, as claimed in claims 7 and 10.

The combination of Nishiyama and Nakatani fails to disclose such relation between the size of the filler particles in the resin and the height of the said electrode.

However, Nishiyama further discloses various type of electrode connection as shown in figure 8, 9 and 10 and Nakatani discloses gold bond or solder bump as electrodes, column 9, 15-24 and furthermore, Nakatani used the inorganic filler in the resin to swiftly conducts heat generated in the circuit components.

Pasch discloses a flip chip die with bump electrode with size of about 50 μm to 100 μm .

Pasch discloses a chip capacitor with external electrodes 4 with the thickness suitably determined in accordance with the particular purpose in the ranges from about 10 μm to about 50 μm .

Papathomas discloses encapsulation with a resin having thermally conductive fillers, such as Aluminum Oxide, Aluminum Nitride, Silicon Nitride, Silicon Carbide, Beryllium Oxide and Boron Nitride to improve the thermal heat transfer from the device to the surrounding, and further discloses that the particle size of the filler should be from 0.5 μm to about 31 μm , so that the uncured composition flows readily and will flow under integrated circuit chip housing 31, between the housing 31 and the substrate 11, see column 14, line 65-67 to column 15, line 1-23.

A person of ordinary skill in the art at the time of applicant's invention, depending upon the connection structure of the electrode of the component with the respective pads on the surface of the substrate would have recognized that providing the filler of the resin compound as small as possible compare to the height of the electrodes of the

electronic component would enhance the heat conduction rate from the electronic component and improve the performance of the device, as the smaller filler particles would help in a better flow of the composition in the narrow regions between the individual electrodes and between the electronic component surface and the respective connecting surface.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide core substrate of the combination of Nishiyama and Nakatani, with the inorganic filler having a particle size not greater than one-half the height of said electrode, as claimed in claim 4 and the inorganic filler having a particle size not greater than 25 μm , and the electrode has a height of at least 50 μm , as claimed in claims 7 and 10, from the teachings of Papathomas, Pasch and Nomura, in order to improve the heat dissipation rate and resultant better performance of the device.

Further, when the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Schmidt discloses a circuit component embedded in the opening in a circuit board.

Murata discloses a passive component embedded in a circuit board.

Tsuji discloses a resin with filler for encapsulating a chip, which will inhibit the occurrence of crack in the resin package.

Chen discloses a printed circuit substrate with cavities for encapsulating integrated circuits.

Fillion et al., discloses chip embedded in the cavity.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ishwar (I. B.) Patel whose telephone number is (571) 272 1933. The examiner can normally be reached on M-F (8:30 - 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamand Cuneo can be reached on (571) 272 1957. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308 0658.



I B Patel
Patent Examiner
GAU: 2827
December 29, 2003